

# Automatic Solar and Celestial Navigation on the Moon and Mars, Phase I

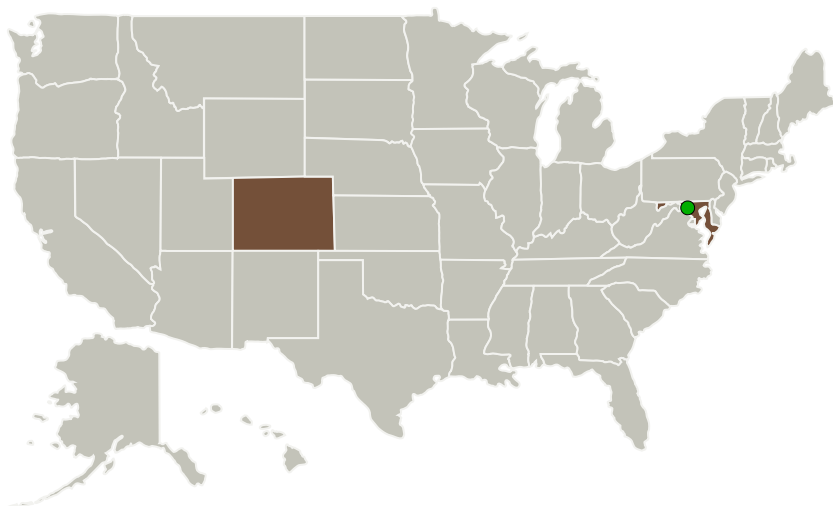
Completed Technology Project (2010 - 2010)



## Project Introduction

Micro-Space proposes to develop a low mass, automated form of the classic navigator's bubble sextant, with no moving parts, for rapid localization and reliable navigation on the Moon and Mars. Day, night, near side and far side lunar operations will all be handled. Exploration of the Moon (or Mars) without navigation aids comparable to those now common on Earth is a daunting, and generally unacceptable concept. Since neither body has a significant magnetic field, even a compass is useless. Creating and sustaining a GPS type satellite constellation will not occur soon. But the self contained, automated system Micro-Space proposes is an excellent substitute. It can be installed on top of an astronaut's helmet, or atop a vehicle, in extended EVA. With exploration extended into terrain where a vehicle is likely to become immobilized, but access by a walking human is practical, vast areas of currently unknown territory can be examined at very close range. But an hour's trek into convoluted terrain can leave the trekker seriously disoriented, and subject to human course decisions which could prove fatal. The helmet mount system will provide continuous EVA crew localization for emergency walk back to a safe haven, even if that path crosses unexplored territory. Fixed asset or notable planetary feature localization will also be straightforward at any point in the EVA. The proposed optical navigation system uses production, solid state camera modules for Solar, Earth Shine, and Celestial sight readings, all with an accurate artificial horizon. But the accuracy required is produced by Micro-Space proprietary "Sub Pixel" processing techniques. Lunar localization accuracy will exceed ¼ mile. With the excellent directional reference also produced, this information will make visual identification of relevant terrain features easy.

## Primary U.S. Work Locations and Key Partners



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Organizations Performing Work	Role	Type	Location
Micro-Space, Inc.	Lead Organization	Industry	Denver, Colorado
● Goddard Space Flight Center(GSFC)	Supporting Organization	NASA Center	Greenbelt, Maryland

Primary U.S. Work Locations	
Colorado	Maryland

## Project Transitions

**January 2010:** Project Start**July 2010:** Closed out**Closeout Documentation:**

- Final Summary Chart(<https://techport.nasa.gov/file/138839>)

## Organizational Responsibility

**Responsible Mission Directorate:**

Space Technology Mission Directorate (STMD)

**Lead Organization:**

Micro-Space, Inc.

**Responsible Program:**

Small Business Innovation Research/Small Business Tech Transfer

## Project Management

**Program Director:**

Jason L Kessler

**Program Manager:**

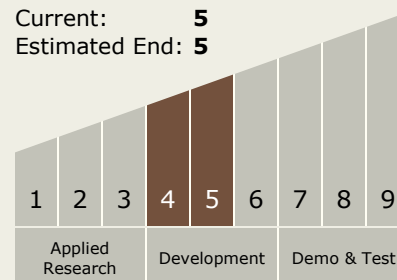
Carlos Torrez

**Principal Investigator:**

Richard P Speck

## Technology Maturity (TRL)

Start: 4  
 Current: 5  
 Estimated End: 5



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## Technology Areas

### Primary:

- TX17 Guidance, Navigation, and Control (GN&C)
  - └ TX17.2 Navigation Technologies
    - └ TX17.2.3 Navigation Sensors

## Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System